DOCUMENT RESUME

ED 283 434 HE 020 408

AUTHOR	White, Michael R.
TITLE	Graduate Education and the Doctor of Industrial Technology Degree: The Purposes, Roles, and Functions. Monograph Series, 2.
INSTITUTION	University of Northern Iowa, Cedar Falls. Dept. of Industrial Technology.
PUB DATE	83
NOTE	15p.
AVAILABLE FROM	Wagner Resource Center, Department of Industrial Technology, University of Northern Iowa, Cedar Falls, IA 50614
PUB TYPE	Viewpoints (120) -- Reports - Descriptive (141)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	College Curriculum; *Doctoral Degrees; Educational Objectives; *Graduate Study; Higher Education; *Industrial Education; *Technical Education; *Technology
IDENTIFIERS	*Industrial Technologists; University of Northern Iowa

ABSTRACT

Professional concerns for graduate study in general and the nature of doctoral degrees in the field of industrial arts are discussed, with specific focus on the Doctor of Industrial Technology (D.I.T.), which is offered as an alternative to the Ph.D. or Ed.D. at the University of Northern Iowa. Three basic purposes of graduate education as specified by the National Board on Graduate Education are: professional education and training, the production of new knowledge, and the preservation and transmission of knowledge. Study experiences for students in doctoral programs may entail formal lecture courses and then activities where knowledge and the use of scholarly tools can be demonstrated. Ph.D., Ed.D., and Doctor of Arts programs are briefly addressed, along with other less known discipline-oriented doctoral degrees. Purposes of the D.I.T. program are identified, including developing knowledge and practice of: industrial technology as a discipline, the behavior of technological systems in industry and their effect on people and environment, and the potential and limitations of future development in technological systems and their utilization in industry. Goals and characteristics of the D.I.T. program are also specified along with a list of core courses and examples of internships completed in D.I.T. programs. (SW)

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Graduate Education
and the
Doctor of Industrial Technology Degree
The Purposes, Roles and Functions

by
Michael R. White, Ph.D.
Professor and Coordinator of Graduate Studies
Department of Industrial Technology
1983

College of Natural Sciences
University of Northern Iowa
Cedar Falls, Iowa 50614

Graduate education has been a viable activity in various fields during most of this century. In the 1920's the masters degree was taking hold as a professional degree objective in industrial education (Buffer, 1979). Doctoral degree programs in industrial arts and trade and industrial education existed in small numbers prior to 1950; however, in the post-war college boom of the 50's-60's, the number of doctoral graduates grew as did most graduate programs. According to the degree listings in the 1981-82 **Industrial Teacher Education Directory** (Dennis, 1981), there are currently 23 institutions offering either the Ph.D. or Ed.D. degree in the field of industrial education. Of these 23 institutions, the EdD. degree is listed for five (5) trade and industrial education programs, twelve (12) industrial arts programs and eight (8) industrial education programs. The Ph.D. degree is offered for four (4) trade and industrial education programs, seven (7) industrial arts programs and seven (7) industrial education programs. Due to the multiplicity of degrees and programs at some institutions, these numbers do not equate to the total of 23 institutions. In addition to these 23 institutions and their respective doctoral programs, there are institutions offering either the Ed.D. or Ph.D. in such related, or possibly related, fields as technology education, vocational education, industrial technology administration, occupational education and career studies. The University of Northern Iowa offers an alternative to the Ph.D. or Ed.D. and that is the Doctor of Industrial Technology (D.I.T.).

As a profession, then, we have not only grown into graduate education very rapidly, but also at a pace that reflects the energy and diversity within the fields of industrial arts, industrial education and industrial technology. The various emphases in graduate education reflect this diversity and growth. As these programs have developed and grown, it is assumed that they have responded to the professional concerns of graduate education in general. It is useful, therefore, to look at some of those general concerns of graduate education.

Purposes of Graduate Education

Graduate study is a rather complex enterprise with a rather extensive history. There are a variety of alternatives for graduate study, both in this country and in other countries, as well as a variety of programs, purposes and objectives. This discussion will specifically focus on one particular alternative for graduate study in the field of industrial technology. Recognizing the plurality of purposes of graduate education, this may serve to illustrate one alternative which may be very appropriate for scholars interested in and concerned about the future of industrial education and the

discipline of industrial technology.

There are many factors which can be examined in respect to the purposes of any graduate program. The three basic purposes of graduate education which were cited by the National Board on Graduate Education (1972) are typical of the triune often given as goals for graduate education. The first objective is the education and training of professionals. This purpose is often stressed in those fields of study which require advanced specialization and some type of professionalism. Typical examples at the doctoral level are the M.D. or D.V.M. degree These require an extensive amount of professionalism, an extensive amount of specialization and an extensive amount of skill development.

The second objective of graduate education appears to be the production of new knowledge; that is, the discovery of what is. The Ph.D. in the sciences, and in some other fields, is an example of this purpose. This production of new knowledge helps to determine and explain natural events so that society's understanding may be increased and progress may be achieved.

Finally, the third basic objective of graduate education cited in the literature is the preservation and transmission of knowledge. This could be exemplified by the Ed.D. degree, the Doctor of Education, or in many cases, the Ph.D. degree for those individuals who are planning to enter higher education positions to transmit new knowledge or to preserve the knowledge of the past for future generations.

By listing these three purposes of graduate education, the National Board was not implying that a doctoral degree should pick one of these and emphasize only that one. What is implied is that any graduate education would, in fact, have some components of each of these purposes. However, it may be true that in any given degree program there may be more of an emphasis on one of the objectives than on one of the others.

Buffer (1979), in discussing the purposes and roles of graduate education in industrial arts, reflects similar objectives. The first is to develop the innate talents of people preparing for specialized disciplines or professions; that is, the preparation of professionals. The second purpose of graduate education is to contribute to the utilization, expansion and transmission of knowledge. The third objective of improving the conditions of people has a different slant on the basic objectives of graduate education. It is, however, very relevant for those in industrial arts teacher education because as teachers of industrial arts, one of the objectives should be to improve the socio/cultural conditions and to insure the optimal development of the students and their progress toward becoming contributing members of society. If these are

the purposes of graduate education, then any graduate program, and especially any doctoral program, must make some attempt to justify its existence and to provide its students with the competencies in those areas which are going to enable them to develop their talents, to contribute to and expand the discipline and to improve the conditions of man.

Spurr (1970) notes that the doctoral degree requires three years of full-time study during which there is opportunity for the student to demonstrate his/her capabilities to do independent work. Typically, this "independent work" results in a dissertation. Spurr notes that the Doctor of Philosophy (Ph.D.) recognizes completed research. It was originally a research degree which emphasized the production of knowledge as the main measure of satisfactory independent work.

Other examples of independent work are recognized by different degree titles. The Doctor of Musical Arts, Musical Composition or Performance recognizes performance. The Doctor of Medicine recognizes clinical competency; the person spends a great deal of time performing clinical activities and must be able to learn and perform those activities very well. The Doctor of Jurisprudence (J.D.) requires the student to obtain the knowledge and capacity to analyze legal problems. What these examples may indicate is that the name of the degree has significance in respect to the purposes of the degree. However, in many institutions throughout the country and throughout the world, some of these differences are no longer valid. Ph.D. programs tend to have much in common with Ed.D. degree programs. Many of the discipline oriented degrees are very much like the Ph.D. and Ed.D. degrees. This tends to cause some confusion in respect to graduate education programs and operation.

Doctoral Program Operation

Looking at a description of a doctoral program in any graduate catalog, a student who is considering doctoral work could see program components which include those kinds of activities listed by the Council of Graduate Schools (1964). A doctoral program might include lectures, seminars, discussions and independent study, all designed to assist a student in the acquisition of and contribution to the knowledge of the field. The field of study that the individual is majoring in, is designed to enable the student to do research and to contribute to the knowledge in the specific field. It should be emphasized that this is not necessarily the same as producing knowledge in the field but contributing to the knowledge in the field.

There is also a progression in the statement by the Council (1964) respective to the sequence of graduate education experiences. Doctoral students may start out in formal lecture courses and then advance to those kinds of activities where knowledge and the use of scholarly tools such as statistics, languages or computer skills can be demonstrated. These are research tools that are crucial to the production and utilization of knowledge in many fields. Frequently, the doctoral student, according to the Council of Graduate Schools, begins his or her research shortly after entering the degree program. Certainly that is the most efficient way to progress through a program: to target career goals and to direct research and independent study activities toward those goals. Perhaps this particular approach is most common in the sciences, or other fields where graduate education tends to be a continually narrowing approach from the bachelors to the doctorate.

For many graduate programs, there is a key step, or key hurdle, as the student progresses through the program. It is called the admission to candidacy. This occurs somewhere along the process from admission to the program to graduation from the program. Depending on the purpose of the admission to candidacy, the student would have different obligations and outcomes. In almost all programs, the admission to candidacy is the acceptance of the student's plan of work toward the degree objective. The final doctoral examination consists mainly of the defense by the candidate of the research and dissertation. This "final defense" is typical of any doctoral program, and it involves defending the new knowledge which the individual has discovered and/or applied to new situations, demonstrating the ability to present this information in a scholarly work called a dissertation and discussing that in front of his/her professors and, possibly, peers.

This is a fairly accurate description of any doctoral program anywhere in the country within any kind of discipline. It is not prescriptive but descriptive of most programs. One of the main concerns which has grown out of this type of graduate program is that it may not be appropriate for all types of doctoral students or for all types of careers that require, or encourage, the doctoral degree. One type of recipient of doctoral degree programs who has been extensively discussed in the last thirty years has been the college teacher who is engaging in doctoral work for the purposes of expanding his or her knowledge and for the purposes of growing in respect to the discipline so that an individual can teach at the college or university level in the discipline in which the training has occured.

Dressel (1972), who has written extensively on curriculum and appropriate educational programs, has noted that certain kinds of concerns have arisen about Ed.D. programs or Ph.D. programs for those who are going to be in the college teaching environment and who are expanding their expertise in that area. Dressel suggests that the prospective college teacher should be directed toward applied research. Applied research implies a deviation from the "production of knowledge" objective. The objective would be to apply the knowledge in the teaching area. Dressel continues to say that problem solving approaches related to teaching or those activities associated with the teaching environment need to be stressed in the doctoral students' program of study, rather than the discovery of new knowledge and the production of this new knowledge. This may be somewhat of a departure from past practices in some institutions. It appears that the emphasis should be on those aspects of scholarship that will continue to be career preoccupations of college teachers. Certainly any university doctoral program that does not teach its doctoral students to engage in scholarly activities and writing functions and to contribute to the literature in their profession through development of certain abilities or refinement of those abilities is probably neglecting one of the main career preoccupations of college teachers; that is, to publish or perish.

This career need is evident in most colleges and universities in the 1980's. Any program that is attempting to prepare individuals for this environment needs to emphasize those aspects of scholarship which will help that individual be better prepared to survive in the occupational environment. Those individuals who are preparing to be college teachers must be able to apply research findings, read research, digest and synthesize that research and apply it to their current classroom situation. Dressel (1972) has suggested that the Doctor of Arts degree was originally designed to meet these kinds of objectives for doctoral graduate education.

The Doctor of Education (Ed.D.) degree, which was originally established at Harvard University in 1920 as a professional degree administered by the School of Education, was developed in response to the need for greater flexibility in doctoral work (Spurr, 1970). However, the changes through the years may have altered the original objectives of this degree. Apparently it is now a parallel degree to the Ph.D. with similar intent, activities and requirements. The main difference lies in the types of research that are permittted at the dissertation stage. There has been some attempt on the part of some Ed.D. programs to provide for a wider range of acceptable projects or special kinds of arrrangements for certain kinds of activities that are more appropriately applied to the

practicing classroom teacher at the university level, the secondary level or in administration.

One of the central issues of this discussion concerning the Ph.D., the Ed.D., the Doctor of Arts degree and other types of doctoral degrees is determining what are the various purposes of specific doctoral degrees. This discussion is still viable in the 1980's. Purists contend that the Ph.D. program exists to train research scholars. Others question whether the Ph.D. should also encompass the preparation of college teachers and advanced professionals in general. Although Ph.D. programs do fulfill the role of preparing college teachers and advanced professionals in general, purists argue that this may not be an appropriate objective for a Ph.D. program.

The Discipline Oriented Doctoral Degrees

An examination of **Peterson's Annual Guides to Graduate Study 1981** (Hegener, 1980), a publication which lists some of the graduate degrees and their programs offered in the United States, will indicate that there are 44 doctoral degrees other than the Ph.D. and Ed.D. The most obvious is the Doctor of Arts, which has been an attempt in the last thirty years to bring about professionalism and a unique degree experience for those preparing to practice their art of teaching in a university or college setting. There are others that may be less well known: the Doctor of Architecture, the Doctor of Engineering, the Doctor of Engineering Science, the Doctor of Library Science, the Doctor of Musical Arts, and the Doctor of Industrial Technology, to name a few. The one common aspect of these degrees is that they are emphasizing the discipline or the area of study, as opposed to the generic designation of Ph.D. or Ed.D.

Since these doctoral degrees are placing the emphasis on the discipline, at least by designation, it is useful to briefly examine the nature and structure of a discipline.

> A discipline develops from the rules or procedures which define its scope and modes of inquiry. Disciplines differ in the rules they accept. Each has its own body of facts, concepts, and principles and its own modes of acquiring and verifying its knowledge. Each discipline has also a subject matter (objects of inquiry) which the practitioners of the discipline aim to investigate. This subject matter may be a natural phenomenon, a process, a material, a social institution, or other aspects of man's interests and concerns. (Dressel, 1972, pp.27-28)

Dressel suggests that a discipline has unique roles and methods of inquiry and that for each discipline the process of studying that discipline and, in fact, the reasons for studying it, may be different than other disciplines.

Industrial Technology is a discipline. It has unique modes of inquiry. It has its own body of knowledge and its unique subject matter. By using some of these discipline specific degree titles, which perhaps are more accurate descriptions of intent and focus on the degree, the institution runs the risk of not appealing to the elitism that is possible with an Ph.D. degree or the acceptance that has developed around an Ed.D. degree. This is the risk that programs are apparently willing to take in an effort to respond to the changing needs of graduate education.

The Doctor of Industrial Technology Degree

Graduate study is indeed a complex enterprise. Some of this complexity is the history that imbues the academic environment and some is in the mixture of novel developments as exemplified by the recent growth in various types of doctoral degrees. The potentiality for the future is exciting to all involved in graduate education. It is especially exciting that unique responses to graduate education are also occurring in the discipline of industrial technology through the development and implementation of the Doctor of Industrial Technology at the University of Northern Iowa. The department and the university have, since 1978, embarked upon an experiment; an experiment which affirms that industrial technology is a discipline, that industrial technology can be studied, can be contributed to, can be taught to others, and can be transmitted to a variety of audiences in a variety of settings for a variety of useful, socially meaningful reasons. This program says to the profession that research in industrial technology is appropriate, necessary and productive and that this scholarly and practical activity contributes to the knowledge and application base of industrial technology.

This discussion of graduate programs has been based upon the purposes of graduate education. It is appropriate, then, to start the discussion of the Doctor of Industrial Technology (D.I.T.) degree with a statement of its purposes. The D.I.T. program is creating an environment where doctoral students develop a knowledge and practice of:

-industrial technology as a discipline,
-the behavior of technological systems in industry and their effect on people and environment,
-and the potential and limitations of future develop-

ments in technological systems and their utilization in industry.

The D.I.T. emphasis is not only on the knowledge of industrial technology, but also on the practice of that knowledge in an organizational setting. Specifically, the program is attempting to meet the following goals:

-provide the doctoral student with the intellectual tools necessary to pursue scholarly research and applied practice in industrial technology,

-provide leadership development in the areas of improving industrial technology programs and operations in industrial or educational organizations,

-offer an individually planned program of studies for the student, targeted at developing specific competencies toward designated career goals in industrial technology,

-allow for the development of continued technical expertise and application of that technical expertise by each student.

In order to accomplish these kinds of goals, it is helpful to examine those common characteristics within the D.I.T. program. The D.I.T. program:

-requires students who are mature professionals in the field of industrial technology,

-provides for technical expertise development within the department and the university,

-requires publication experience prior to dissertation proposal,

-requires industrial or educational internship (300 contact hours/6 semester hours of credit),

-and provides an individually planned program based on student written diagnostic tool-the Candidacy Examination (C.E.).

Some of these characteristics are similar to other doctoral degree programs. The first is important to the efforts of the D.I.T. Since the program is planned, in part, by the student/advisor, it is important that the individual student has a clear idea as to his/her career goal and what competencies are necessary to successfully enter into that career goal. A person with some experience in the field may have a better perspective on personal capabilities and career/professional direction.

Another characteristic of the D.I.T. degree is that courses and experiences in the technical area can be built into the student's program. This characteristic is especially crucial to the college or university faculty member who sees the need for updating techni-

cal competencies as part of the doctoral program. Individuals with the career objective of teaching at the college or university level in the discipline of industrial technology will find ample opportunity in the department to take technical courses and experiences to build upon their previous degree work and upon their teaching experience in their technical field.

The D.I.T. program requires the student to have publication experience before a proposal for a dissertation is submitted. This means that a doctoral candidate would have to demonstrate to his or her advisor and committee that he or she has produced something that is publishable. This can mean that it has been accepted for publication, that it has been submitted for publication and is under consideration, or that it was actually published.

The required internship is an additional opportunity for the doctoral student to apply knowledge gained in the doctoral program to a practical, career related area. This internship is educational in nature, but it is also application oriented. The intern is supervised by the cooperating agency or industry with support and supervision from the university. Some of the internships can be related to the dissertation topic, or they may provide a capstone experience for the doctoral student. It is possible for the doctoral student to participate in both an industrial and educational internship. Some of the internships completed in D.I.T. programs are:

-a special project assignment with a Fortune 500 firm to increase indirect labor productivity in maintenance,
-estimating and scheduling functions for a multi-million dollar commercial construction firm,
-development of a component of a training program for a major oil company,
-an on-site examination and evaluation of welding training programs in selected European technical institutes,
-management and development of a computer assisted materials selection technique for a manufacturing firm,
-a construction management experience in a heavy construction industry in a developing country,
-and the development of educational linkages between public school and university personnel.

One of the most important characteristics of the Doctor of Industrial Technology program is the Candidacy Examination (Personal Career Development Plan). This is required during the first or second semester of residency and this process is based on the premise that a significant part of a mature student's doctoral pro-

gram should be planned by the student to meet his or her educational and career needs. The method used to do this is the Candidacy Examination or the C.E. It is not an examination in the sense of a testing procedure but more of a professional self-evaluation and indepth analysis of the career literature in a particular area of industrial technology. The process and advantages of this type of program planning were explained in detail by Passmore and Swanson (1981).

The emphasis of the Doctor of Industrial Technology degree, then, is on developing those intellectual and practical competencies that need to be applied to the field of industrial technology. Like all doctoral programs, the goal of the D.I.T. is to contribute to the professional development of leaders in the discipline. Some of the components of the doctoral program, as discussed, are unique to each individual. The common core of experiences for the D.I.T. program is designed to provide the student with those knowledges and skills that will serve as a necessary foundation for any advanced career goal in industrial technology.

The required part of the doctoral program is called the Core Program:

Industrial Technology Foundations
- Historical Developments in Industrial Tech. ... 3 sh
- Contemporary & Future Developments in Industrial Technology ..... 3 sh
- Readings in Technology & Society ..... 3 sh

Seminars
- Industrial Technology Seminar (Students must enroll in one-semester hour seminar during each summer session and semester while meeting residence requirements) ..... 4 sh

Research, Statistical Methods & Computer Programming
- Research Methods in Industrial Technology ... 3 sh
- Statistical Methods in Education & Psych. ..... 3 sh
- Fundamentals of Computer Programming ..... 3 sh

Internship
- Internship in Industrial Technology ..... 6 sh

Dissertation
- Research ..... 12 sh

TOTAL ..... Required Core Program–40 sh

Beyond these courses and experiences, the individual student will plan for specific competencies through specific courses and experiences. The total number of post masters semester hours required for the D.I.T. program is 64. Progression through the

D.I.T. program is sequential and deliberate and places the emphasis on the development of the competencies detailed in the Candidacy Examination.

The dissertation research topics for the D.I.T. program range from educational concerns in industrial arts to highly technical and specific technologies in a selected technical area. The key direction of these topics comes from the career goals outlined by the student in the candidacy process.

The Doctor of Industrial Technology (D.I.T.) degree program at the University of Northern Iowa is preparing individuals today to contribute to the discipline of industrial technology and to grow in their professional development toward specific and defined career goals in the educational or industrial environment. As this discipline matures and grows, the need for graduate study in this field will also increase. Trivett's (1977) comment may serve the industrial technology profession as a guidepost for developing graduate education programs that will impact upon the twenty first century.

> Graduate study is a complex enterprise; it is both a legacy of the past and a mixture of novel developments and potentialities for the present and future (p. 1).

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